JAN 27 2005
PATENT & TRADEMARK OFFICE

FIG. 1

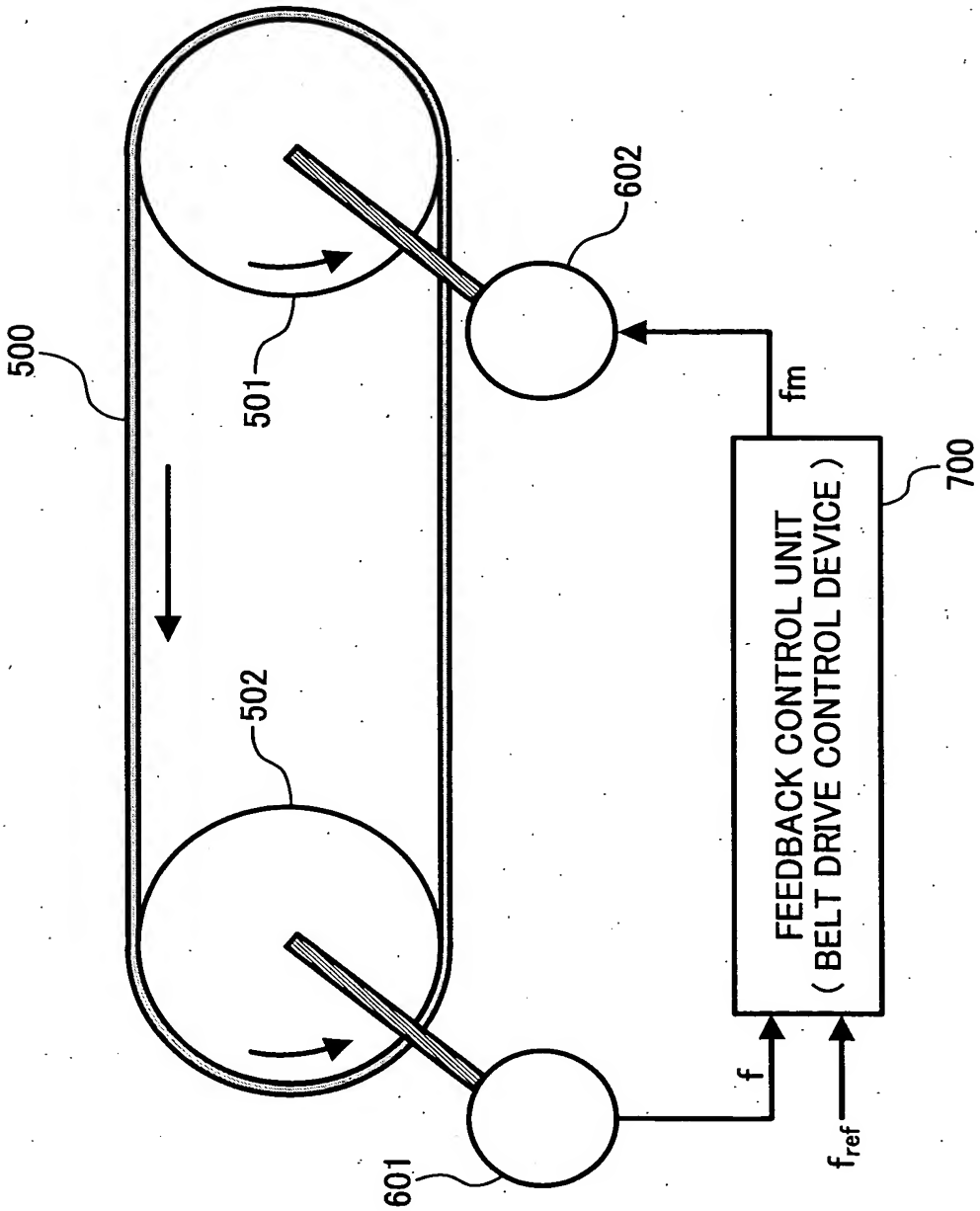


FIG. 2A

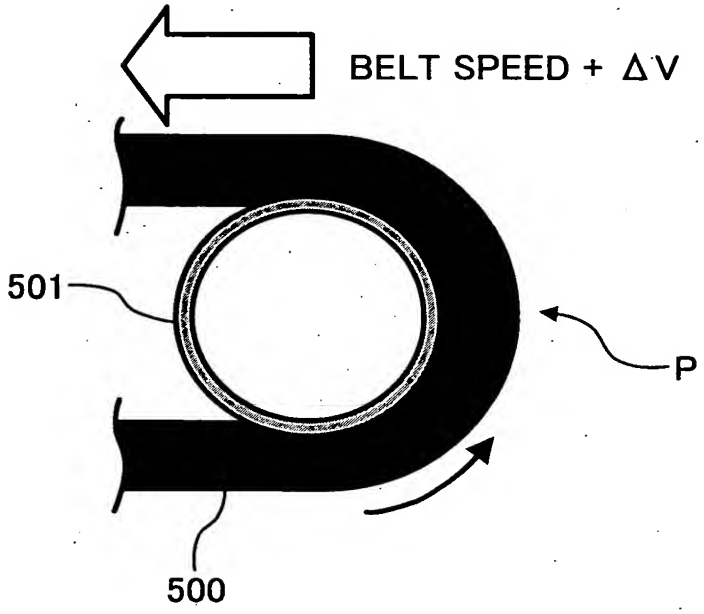


FIG. 2B

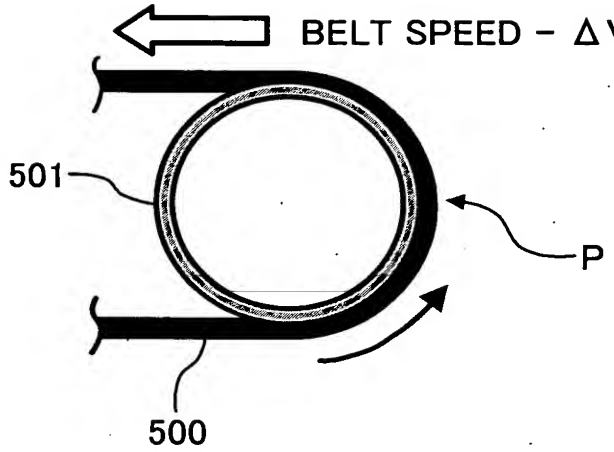


FIG. 3A

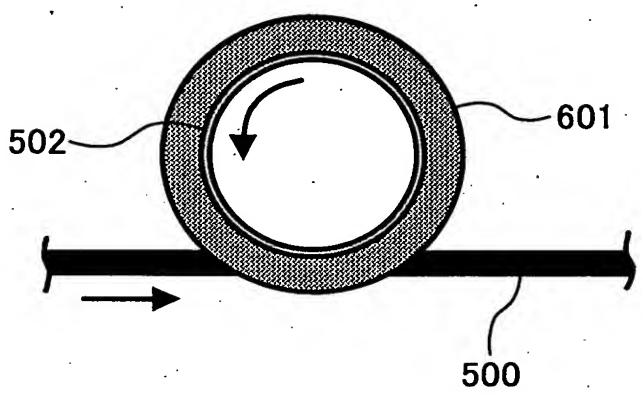


FIG. 3B

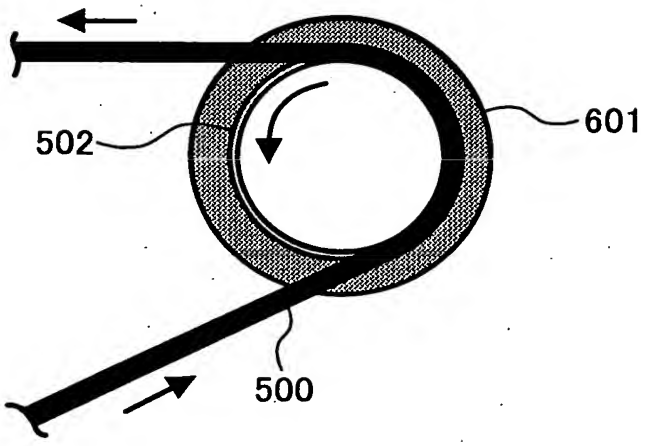


FIG. 4

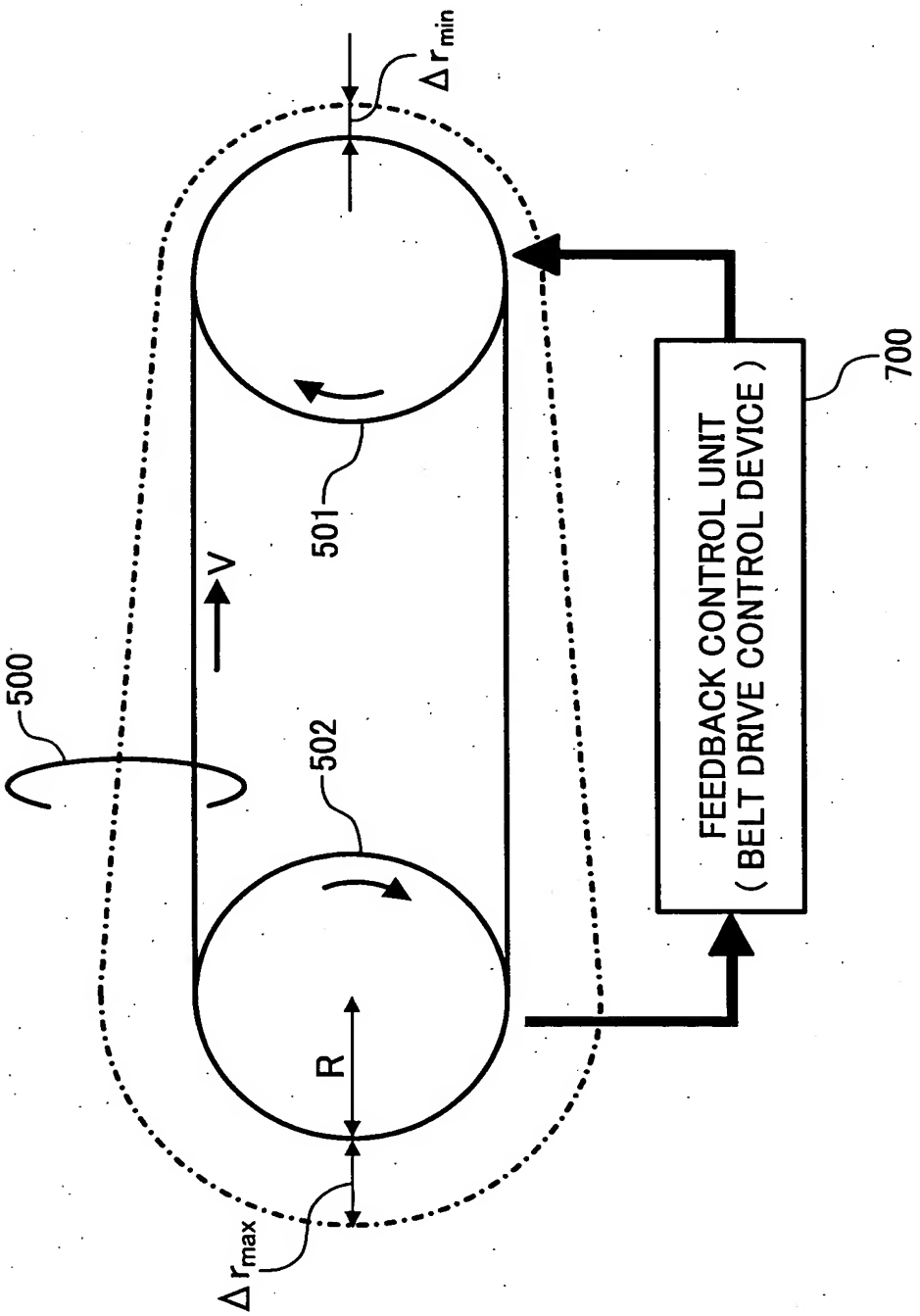

Δr min
501
V
500
502
R
Δr max
FEEDBACK CONTROL UNIT
(BELT DRIVE CONTROL DEVICE)
700

FIG. 5

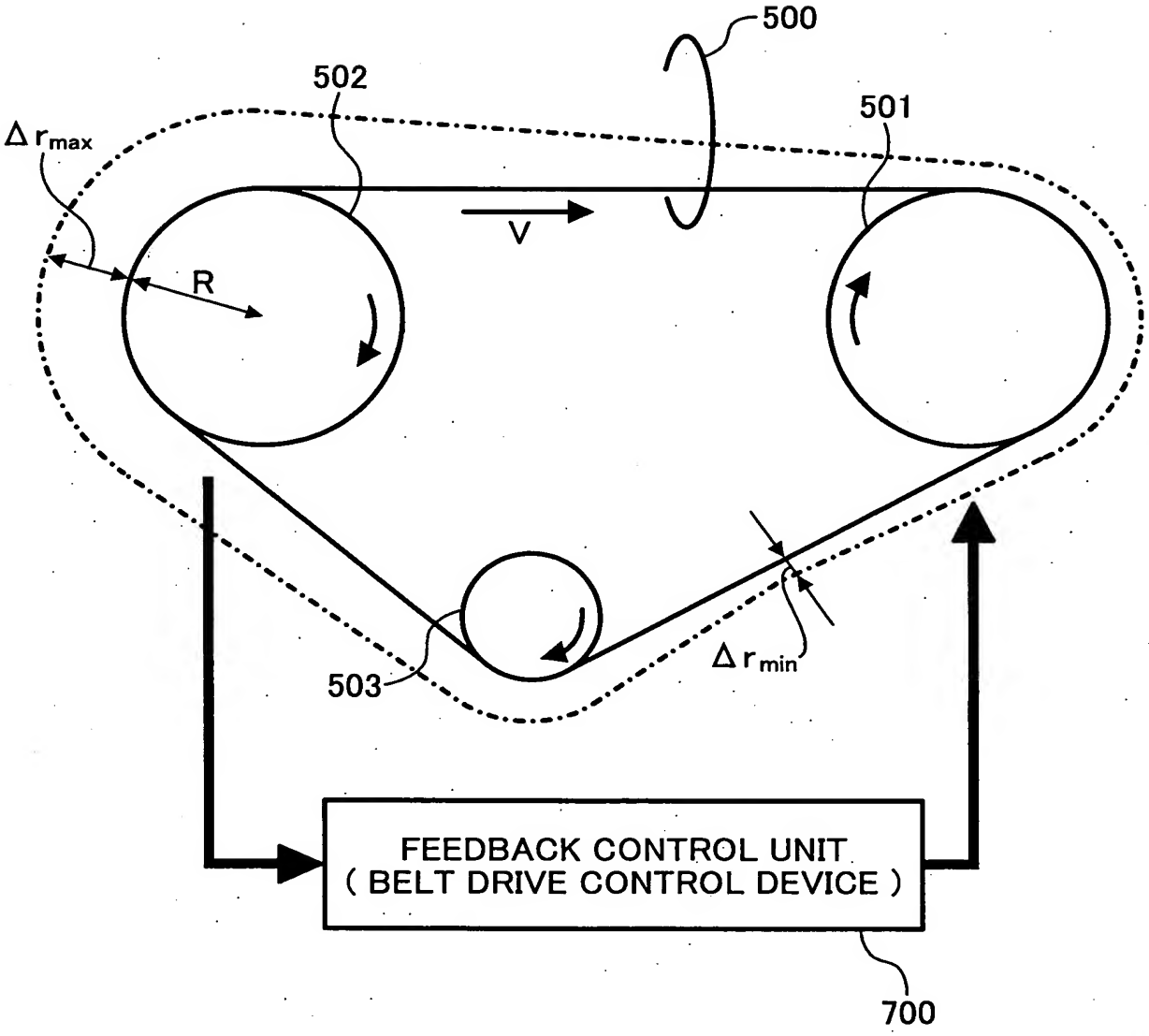

500
502
501
Δ r max
V
R
503
Δ r min
FEEDBACK CONTROL UNIT
(BELT DRIVE CONTROL DEVICE)
700

FIG. 6

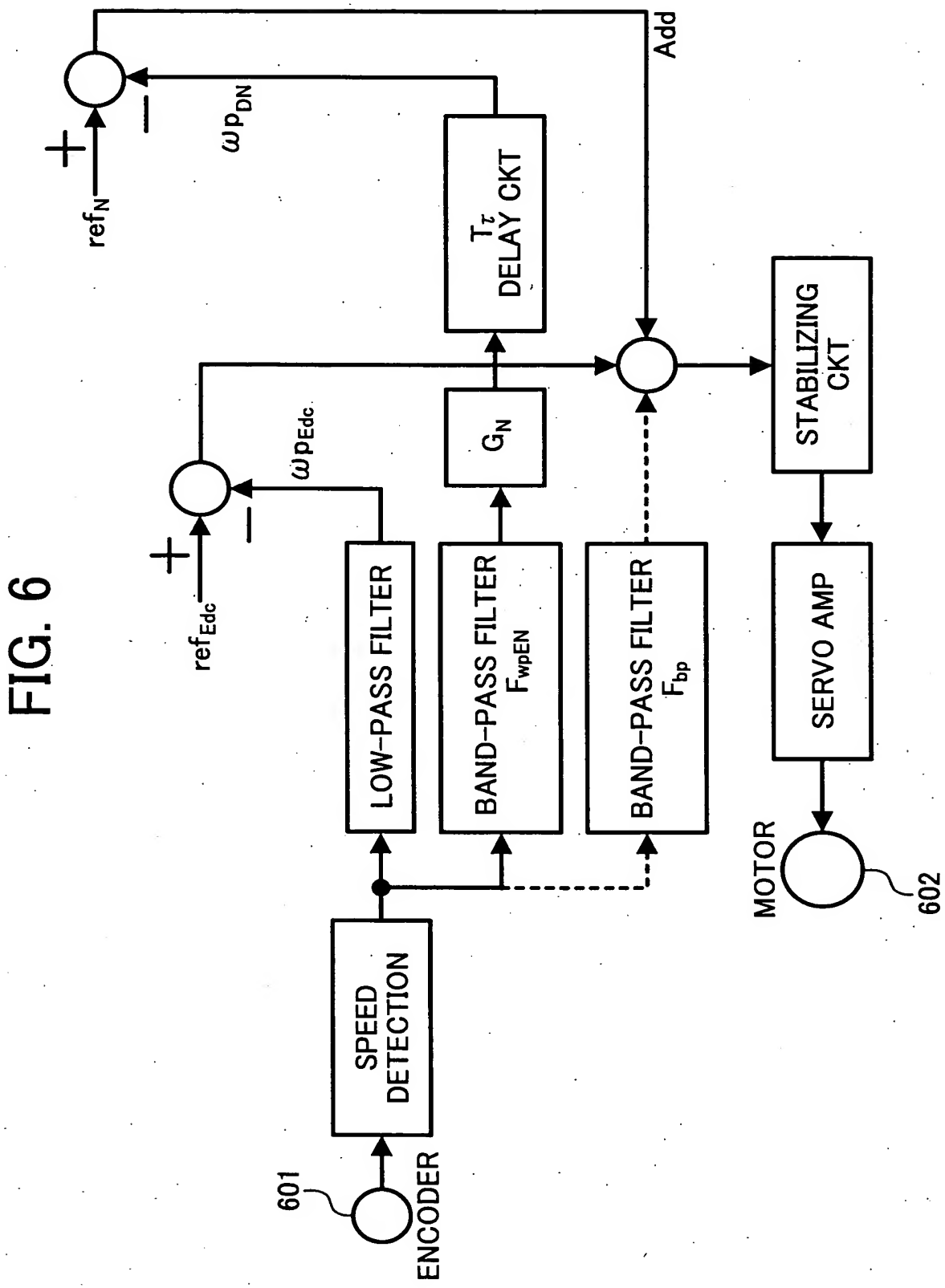

Add
ωp_{DN}
ref_N
T_τ DELAY CKT
G_N
ωp_{Edc}
ref_{Edc}
LOW-PASS FILTER
BAND-PASS FILTER F_{wpEN}
BAND-PASS FILTER F_{bp}
STABILIZING CKT
SERVO AMP
MOTOR
602
SPEED DETECTION
601
ENCODER

FIG. 7

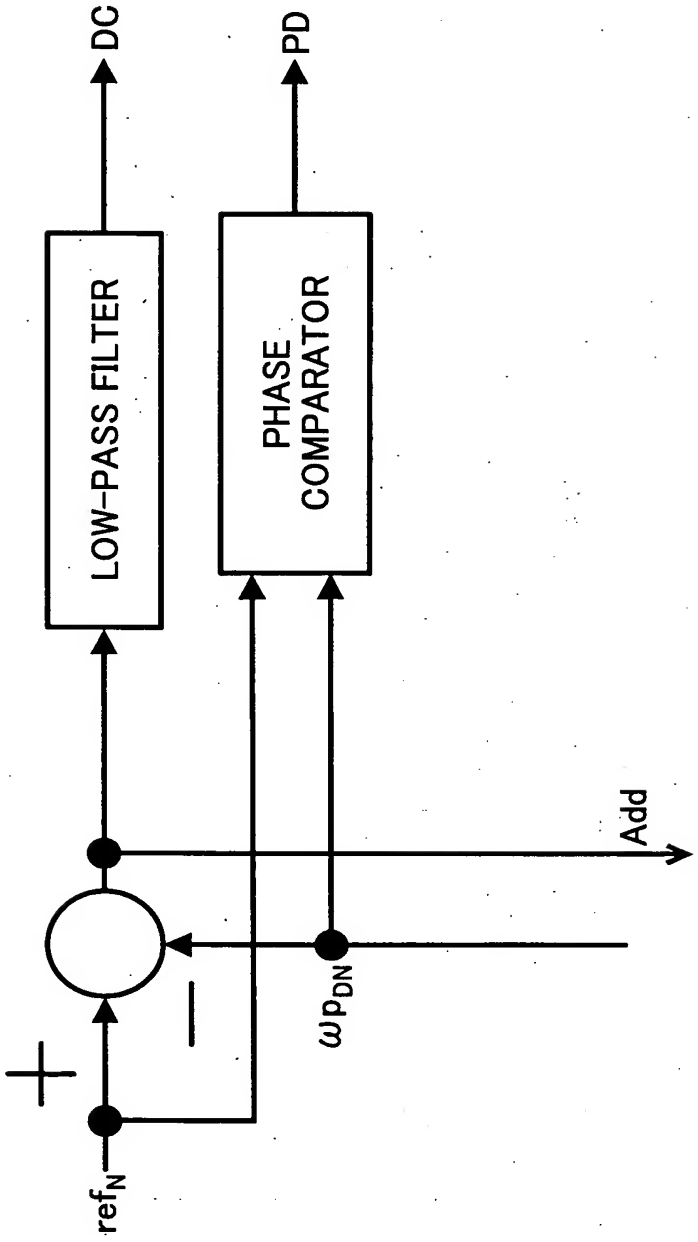


FIG. 8

$C^2=A^2+B^2-2AB\cos(a-b)$

$B/\sin c=C/\sin(a-b)$

$X=C\sin(a+c)$

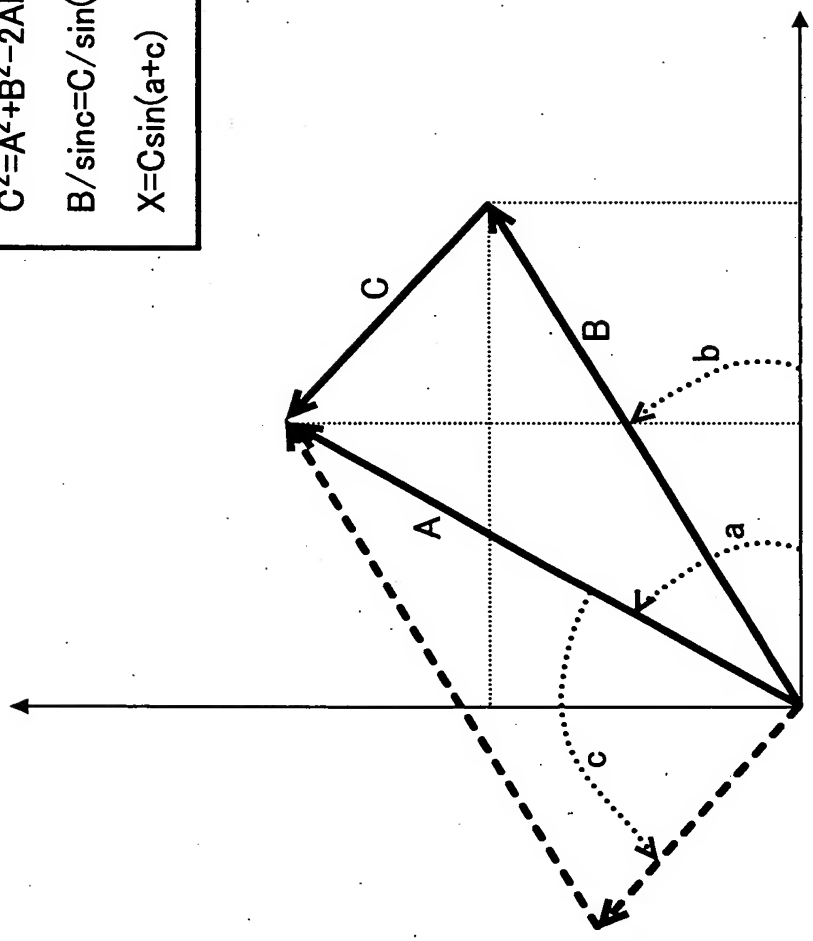
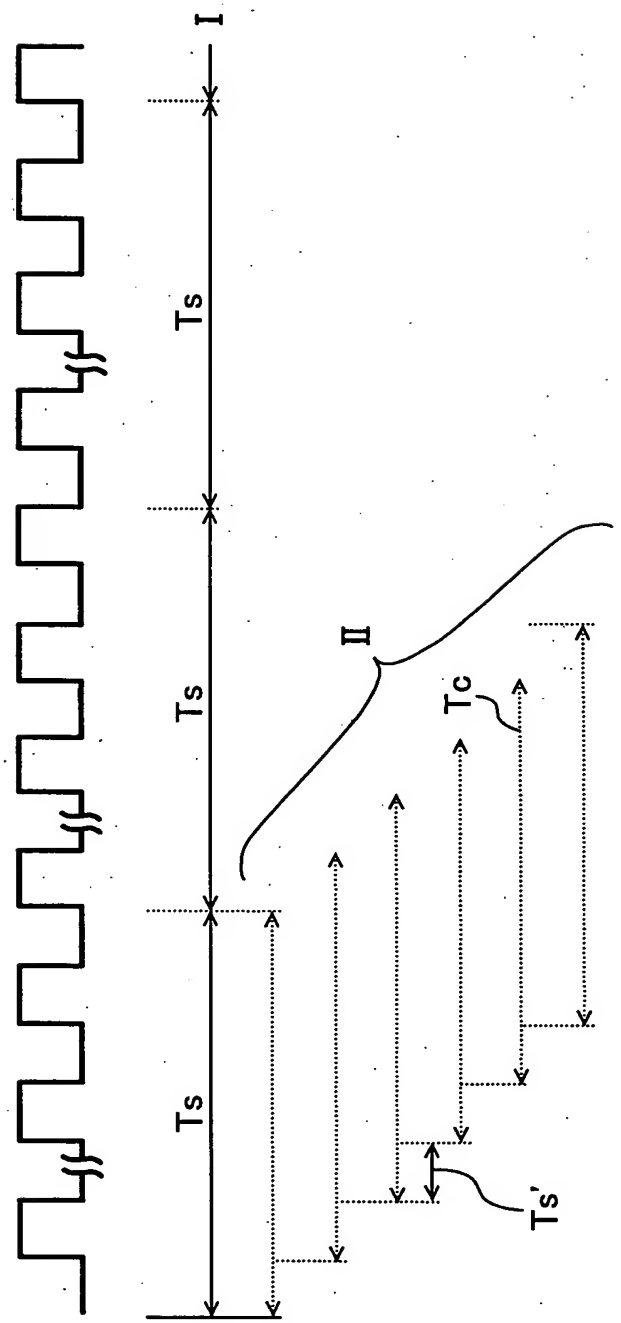


FIG. 9



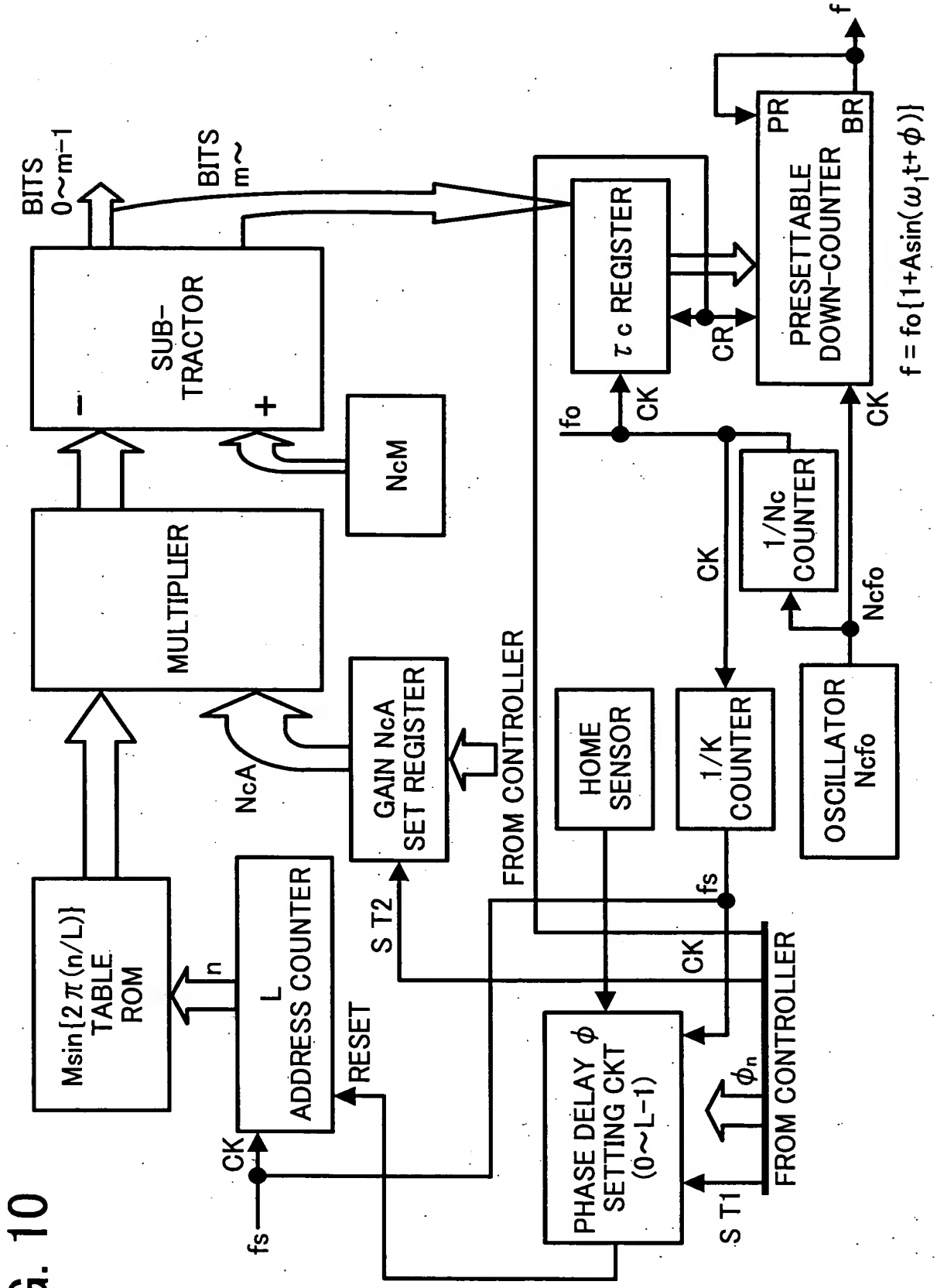

BITS 0~m-1
BITS m~
SUB-TRACTOR
−
+
NcM
MULTIPLIER
NcA
GAIN NcA SET REGISTER
FROM CONTROLLER
Msin{2π(n/L)} TABLE ROM
n
L ADDRESS COUNTER
RESET
CK
fs
S T2
PHASE DELAY φ SETTING CKT (0~L-1)
φn
FROM CONTROLLER
S T1
HOME SENSOR
1/K COUNTER
OSCILLATOR Ncfo
Ncfo
1/Nc COUNTER
τc REGISTER
fo
CK
CR
PRESETTABLE DOWN-COUNTER
PR
BR
f
f = fo{1+Asin(ω1t+φ)}

FIG. 10

FIG. 11

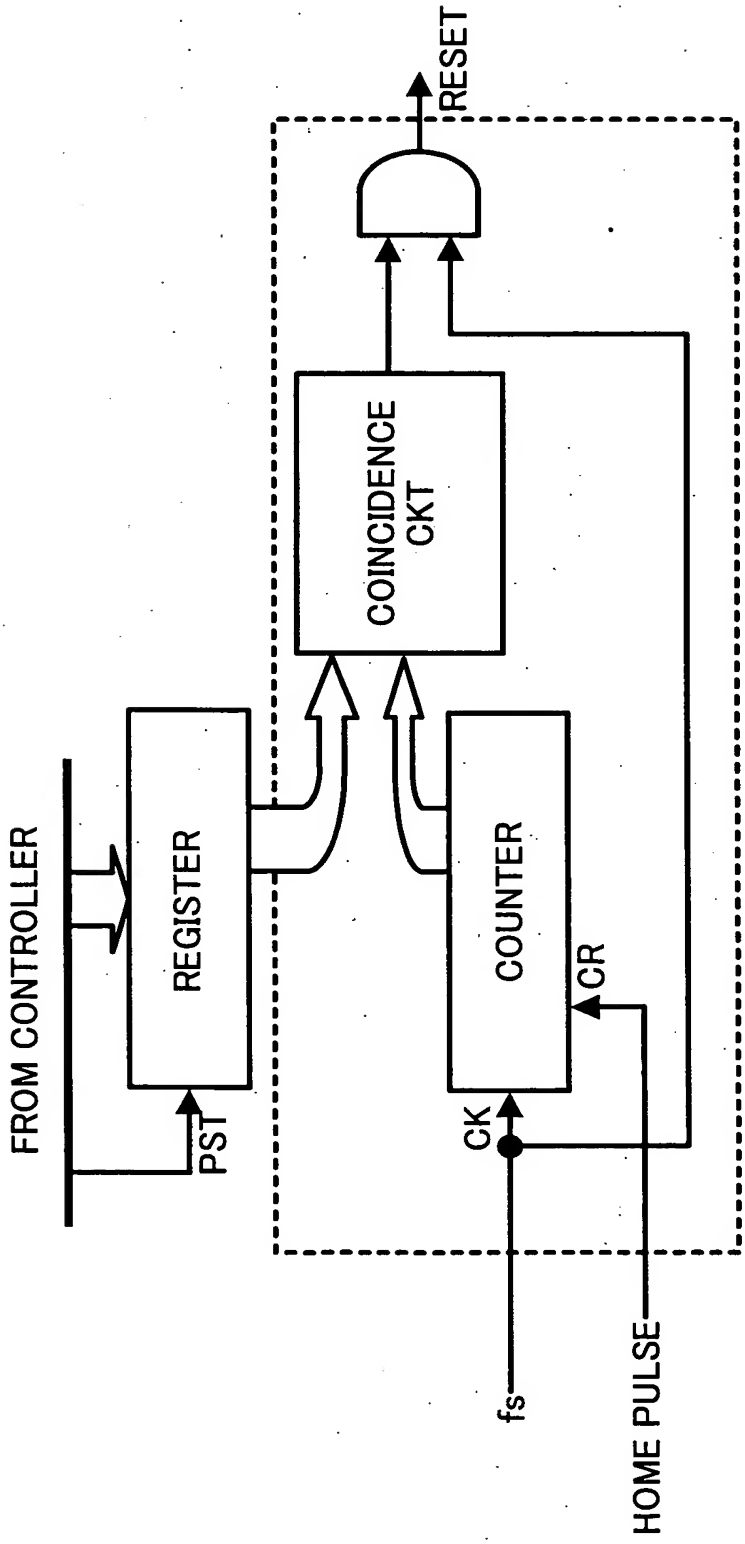

RESET
COINCIDENCE CKT
REGISTER
COUNTER
FROM CONTROLLER
PST
CR
CK
fs
HOME PULSE

FIG. 12

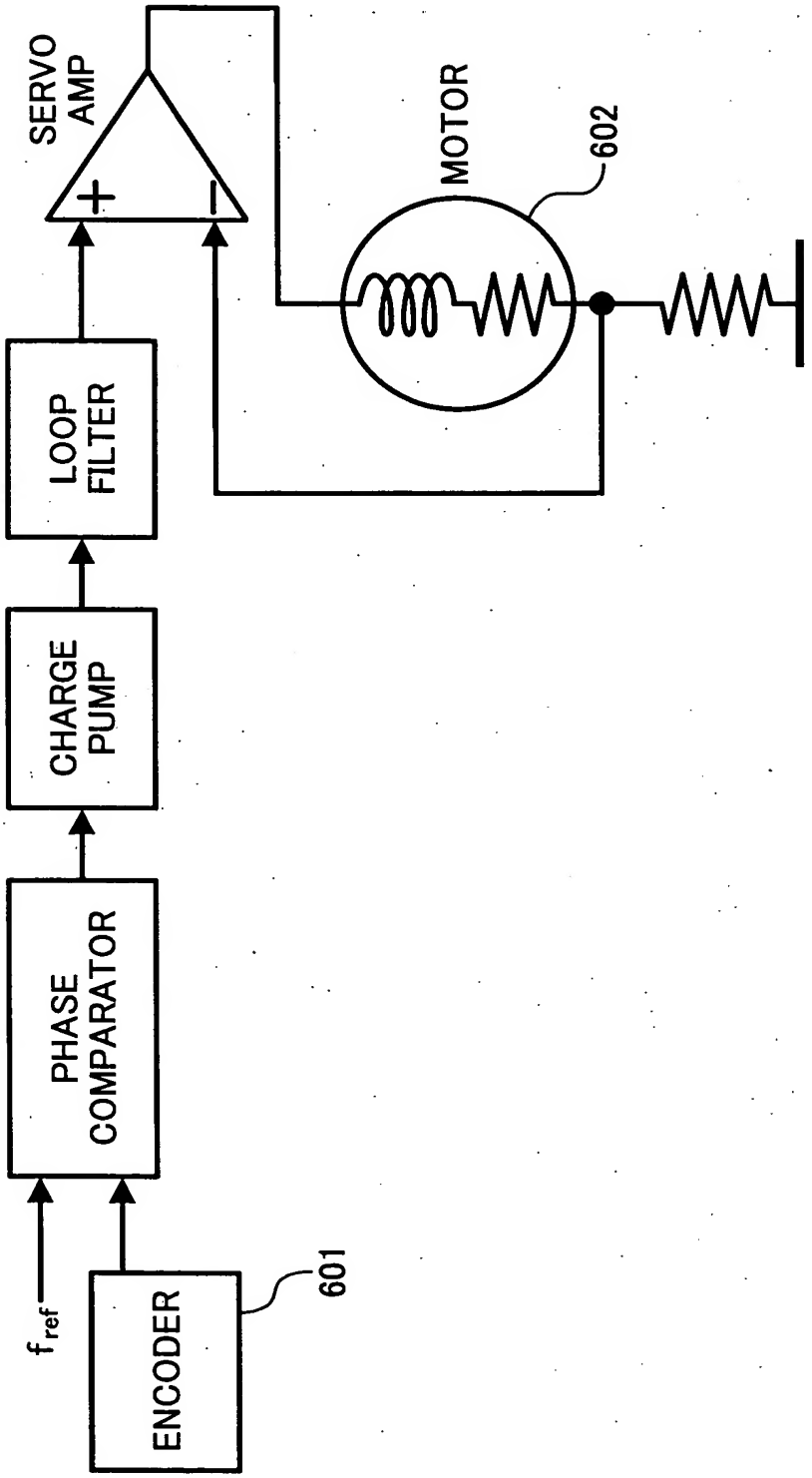

SERVO AMP
+
−
MOTOR
602
LOOP FILTER
CHARGE PUMP
PHASE COMPARATOR
ENCODER
601
f_{ref}

FIG. 13

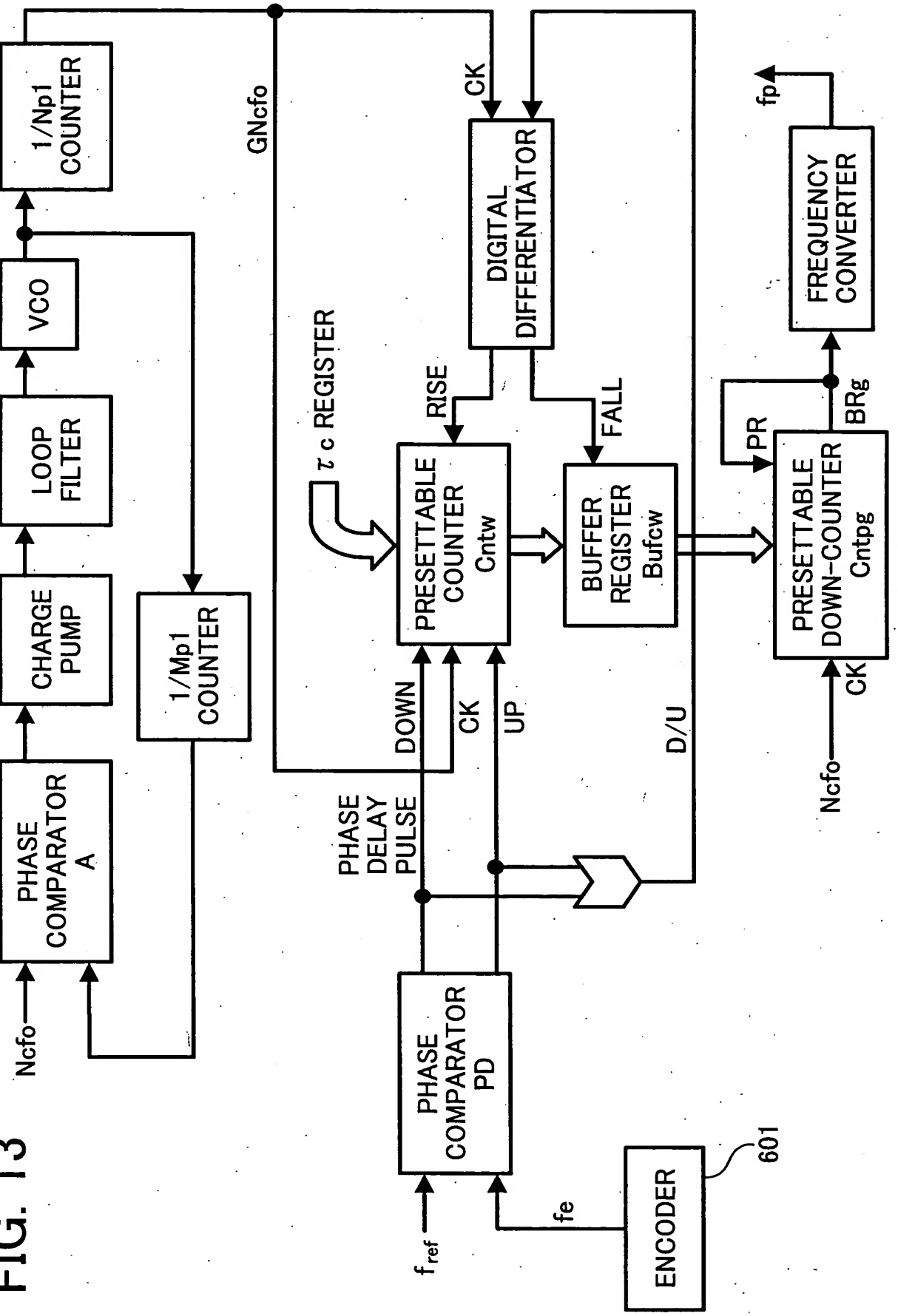

1/Np1 COUNTER
VCO
LOOP FILTER
CHARGE PUMP
PHASE COMPARATOR A
Ncfo
1/Mp1 COUNTER
GNcfo
CK
DIGITAL DIFFERENTIATOR
RISE
FALL
τc REGISTER
PRESETTABLE COUNTER Cntw
BUFFER REGISTER Bufcw
DOWN
CK
UP
D/U
PHASE DELAY PULSE
PHASE COMPARATOR PD
fref
fe
ENCODER
601
fp
FREQUENCY CONVERTER
PR
BRg
PRESETTABLE DOWN-COUNTER Cntpg
CK
Ncfo

FIG. 14

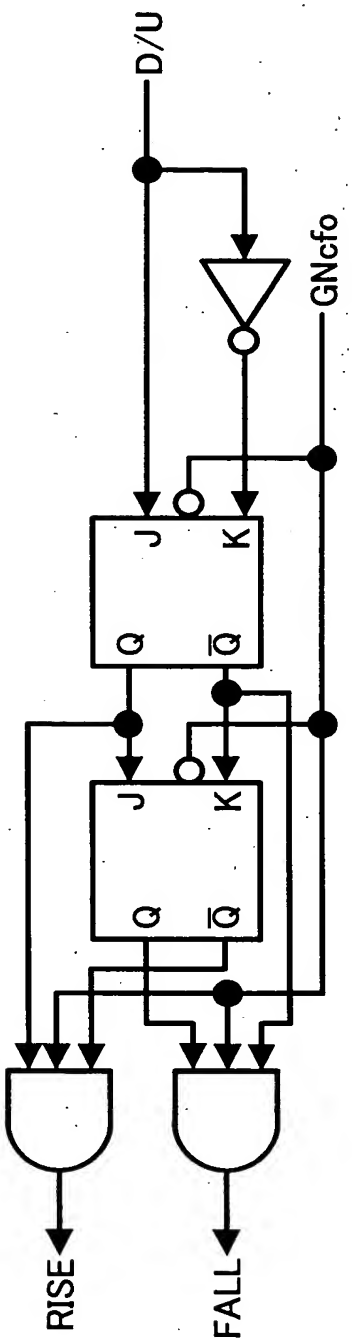


FIG. 15

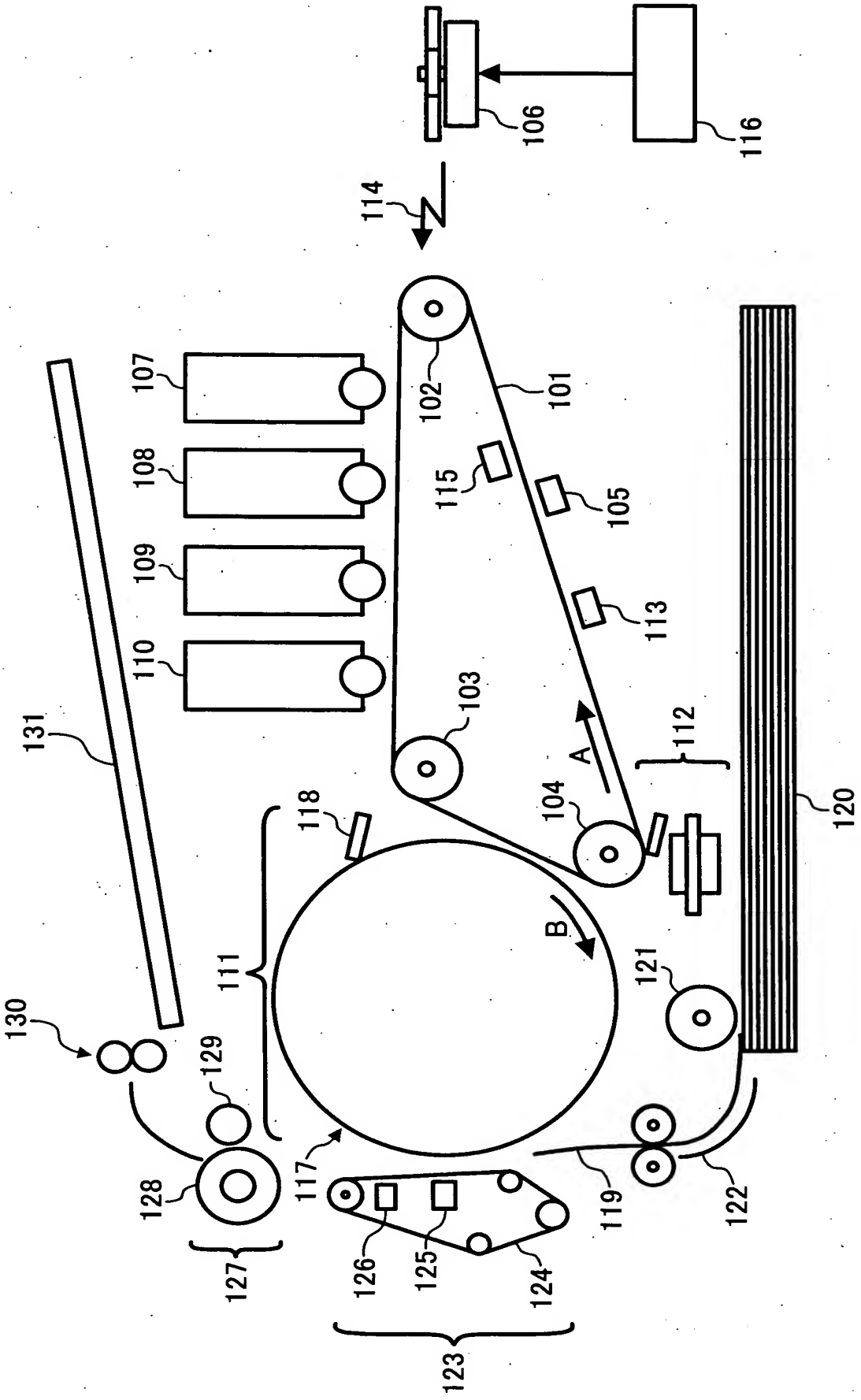

106
116
114
107
108
109
110
102
101
115
105
113
103
112
A
104
118
120
131
111
B
121
130
129
128
117
119
122
127
126
125
124
123

FIG. 16

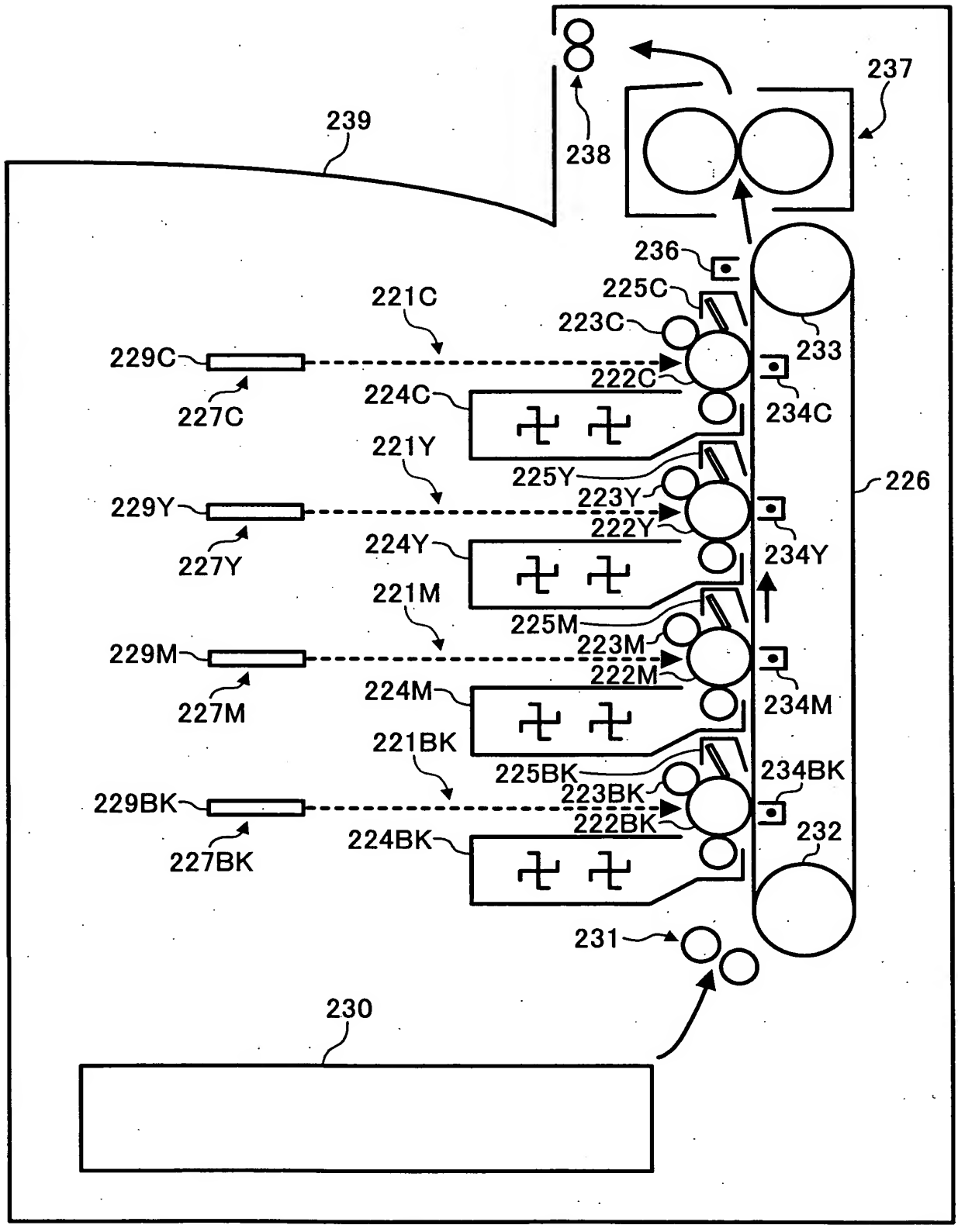
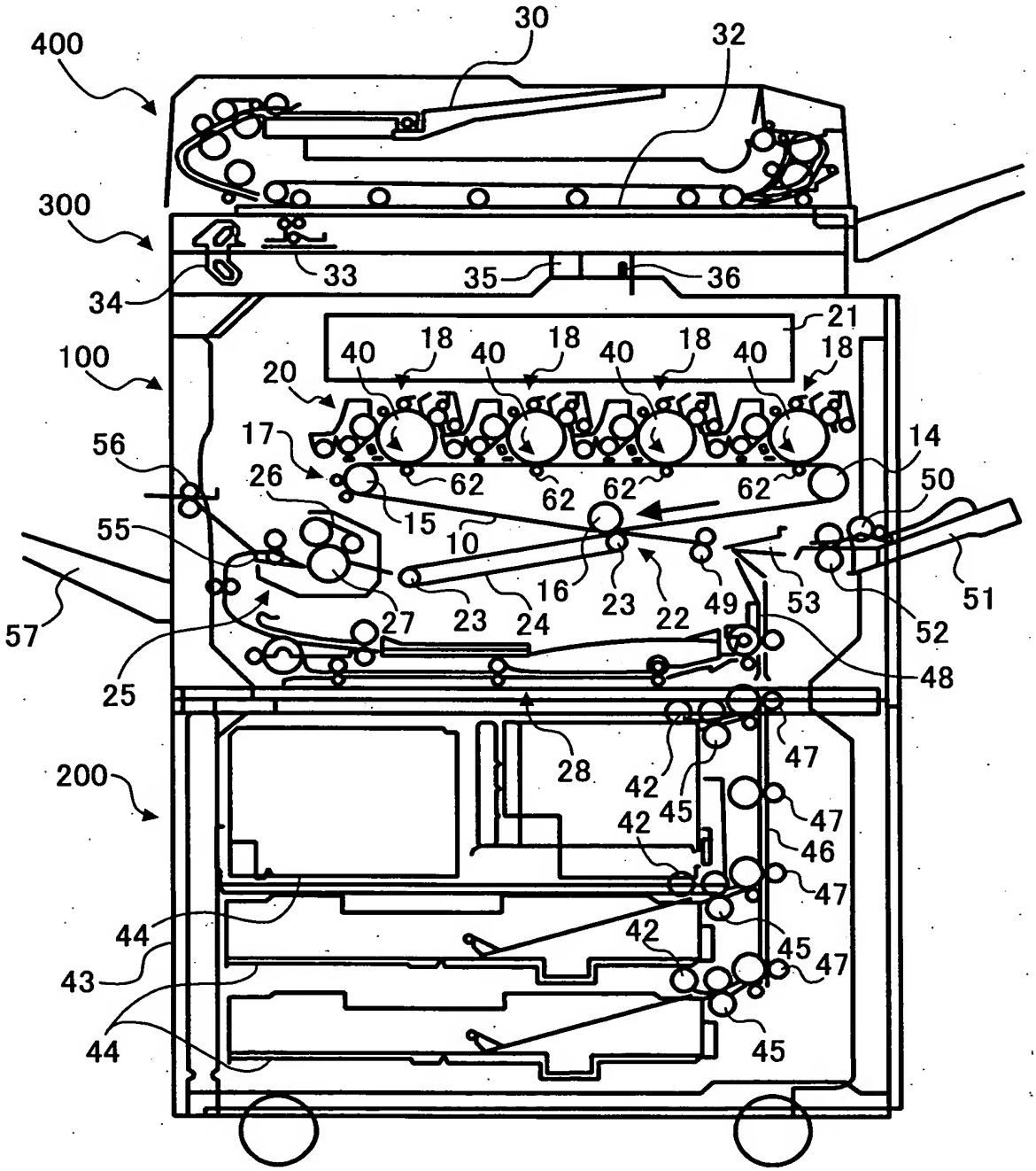

237
239
238
236
225C
221C
223C
233
229C
222C
227C
224C
234C
221Y
225Y
226
229Y
223Y
222Y
227Y
224Y
234Y
221M
225M
229M
223M
222M
227M
224M
234M
221BK
225BK
234BK
229BK
223BK
222BK
227BK
224BK
232
231
230

FIG. 17


400
30
32
300
33
35
36
34
21
100
40
18
20
17
14
56
26
62
50
15
10
55
16
23
22
49
53
51
57
27
24
52
25
48
28
47
200
42
45
46
44
43